

1 experiment and develop these devices. And you know
2 what? It's like common sense would argue against
3 this being able to work at all, but it does. Okay?

4 And that, I've been running an experimental
5 network in the Bay Area since 1996 using all three
6 bands, 900, 2.4, and 5.7 gigahertz, offering
7 services from 100 kilobits up to 30 megabits. And
8 for instance, I operated on 900 in the presence of
9 Metricom with no problems, and it all had to do
10 with the --

11 DR. LUCKY: You don't have that problem
12 any more.

13 MR. HENDRICKS: Well, I was able to do
14 that by, you know, the proper engineering. And I
15 think that what people who have been using these
16 bands is that, you know, there is physics, there
17 is science, and if you use them with good sense,
18 then you can get things to work. And so there are
19 a lot of anecdotal experiences about interference
20 and whatever, but the fact remains that there are
21 still people out there delivering services and
22 doing it very well.

23 DR. LUCKY: Okay. Let's -- I would
24 like to bore into this issue a little bit more,
25 because it's a really big issue here, and that is,

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1 the question of interference in this band. You
2 hear all the time that, you know, you can't depend
3 on this because it's going to melt down, you know.

4 Everybody is going to be jumping in there. You've
5 got cordless phones. You've got microwave ovens.
6 You've got garage door openers, you know. You've
7 got wireless cameras, video cameras, and they're
8 all operating uncoordinated, which is an issue
9 we'll have to get into later. But the issue is, is
10 this going to disintegrate to where it'll be like
11 CB radio and useless, and what are the
12 implications? So let me ask if any of the other
13 panelists who haven't yet had a chance to speak,
14 would like to put in their two bits on this
15 question?

16 MR. CHAMBERLAIN: Well, first, I would
17 say that expecting uninterrupted service on any one
18 of these bands is improbable. And frankly
19 speaking, I think people have come to expect it,
20 but what it has done, it has spurred on the
21 development of new technologies.

22 For instance, in the cordless phones,
23 we started out with analog systems. Interferences
24 in the, you know, 50 megahertz band. All of a
25 sudden, there's moves to 900 analog, and now you

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1 have spread spectrum devices, frequency hopping,
2 combinations of the two, but the marketplace has
3 demanded this, because what they said is they want
4 more reliable services. Things got more and more
5 congested, so what really has happened is, the
6 marketplace goes and says we want better service.
7 We, as electronic companies, go out and say okay,
8 let's develop the new mousetrap, the new system,
9 make it more reliable.

10 Usually, these systems cost a little
11 bit more initially, and then as vines go up,
12 acceptance goes up, they become more proliferate,
13 prices go down, and the next new technology is
14 developed as interference starts increasing in that
15 area. So I think the marketplace has done a great
16 job at producing solutions to these interference
17 issues. And by the way, CB is not dead. I had to
18 say that.

19 DR. LUCKY: Okay. But the concept is,
20 we'll invent our way out of this, and that we'll be
21 incented to do that.

22 MR. CHAMBERLAIN: Correct.

23 DR. LUCKY: So that, in fact, you don't
24 believe that this will melt down.

25 MR. CHAMBERLAIN: Not at all.

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1 DR. LUCKY: Okay. Other opinions?
2 Okay. David.

3 MR. REED: I just want to say that my
4 earlier comments really fit into that thing. The
5 question is, you know, when you say "We're going to
6 invent our way out of this", the question is, you
7 know, is there going to come a fundamental limit
8 where we can't? And the point that I was trying to
9 make earlier is, that there's no real fundamental
10 limit where we can't invent our way out of this, so
11 we ought to create the incentives to invent, rather
12 than the incentives to slow invention.

13 I think the -- what's a really good
14 analogy here is our national highway system where,
15 you know, we constantly run into new problems
16 operating that system. But ultimately, the users
17 are responsible for coordinating their actions, and
18 avoiding crashing into each other, and so forth.
19 We give them new tools occasionally. We might, you
20 know, as in California, create, you know, traffic
21 lights on the on-ramps to the expressway, as we had
22 to in certain cases or whatever, but we don't have
23 to design the system so it doesn't run into
24 problems beforehand.

25 DR. LUCKY: Have you tried to drive on

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1 the 405 in L.A. lately? It's like --

2 MR. REED: They need a new innovation.

3 But, you know, I'm just pointing out that --

4 MR. HADINGER: I wanted to thank David
5 for providing me the segue. I was going to
6 apologize to everybody for being late. I was
7 actually stuck in traffic. When in a cab, one can
8 either worry about being late, or even
9 philosophize. And in this particular case, there
10 was an accident, and it was holding up traffic.
11 And it got me to thinking that, in fact, what's
12 happening is we've got a violation of the expected
13 norms.

14 In other words, there's a group that is
15 all expecting a certain thing, and working in
16 cooperation, like-systems sharing with like-
17 systems. And actually, a fair amount of flexible
18 interchange among those like-systems, but when
19 somebody violates that set of expectations, it
20 causes ripple effects for everybody else.

21 In fact, there's a number of different
22 classes of like-systems. If you think about
23 transportation in that roadways, while they are
24 limited in terms of your freedom to choose exactly
25 where you want to go, nonetheless, carry a high

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1 volume of people all intending to go the same
2 direction.

3 Walking, on the other hand, is
4 completely open, or certainly more open. Although
5 even there you have to, from time to time, step
6 aside to avoid running into somebody in front of
7 you. In the software-defined radio sense, I guess
8 you might consider that to be unlicensed use, where
9 you expect a certain amount of interference, but in
10 fact, what you've done is, you've designed a system
11 which is robust enough that it can tolerate that.

12 Whereas other systems, which require a
13 certain greater degree of harmonization, can handle
14 less in the way of random events going every which
15 way. It's unlikely that we would have an
16 efficient highway system if we just paved over
17 D.C., and let everybody drive straight from their
18 source to their destination at random.

19 In fact, there is value in having like-
20 systems brought together and in conformance. And
21 certainly, a lot of software-defined or self-
22 defined rules for sharing, and moving, and
23 optimizing that space but, you know, within systems
24 which are basically similar.

25 DR. LUCKY: Well, that's an issue that

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1 we do have to get into, is that in the present
2 unlicensed band, people obey their own rules. So
3 you've got some people obeying the 802.11 rules of
4 listening before they talk, and others like video
5 cameras that are just blasting away. So are you
6 saying that there should be rules?

7 MR. HADINGER: Let's see. For systems
8 operating in an unlicensed band, and where you go
9 into it knowing that there are no rules, one would
10 imagine if you're trying to create a robust system,
11 you will choose a protocol which is, in itself,
12 robust.

13 Certainly, there's ways of violating
14 even robust protocols. And at some point, I think
15 there may need to be a mechanism by which we allow
16 a commons for the sort of experimental and first
17 use, but eventually find a way of migrating it into
18 spectrum, again where sort of like-systems obeying
19 the same like-rules, follow similar procedures.
20 And certainly, there's no end of opportunity to
21 find stories of services which have come out with
22 lots of great promise, for which spectrum has been
23 allocated in great amounts, and which is not then
24 turned into a valid and viable service.

25 There needs to be a way of recycling

1 that spectrum efficiently, Darwinian sort of
2 fashion, but also to take those systems which are
3 successful and which may find, because of their
4 broad use, a need for more protection than they had
5 imagined when it was first out, to find a way of
6 moving those people to spectrum, which is, in turn,
7 more protected.

8 DR. LUCKY: Other comments about this?

9 The original question, and we're moving around to
10 a lot of issues that I think have to be gone into
11 in more detail as the day goes along, the original
12 question was will these bands melt down? And if we
13 could sort of keep on that theme, but there's a
14 very important sub-theme here about whether there
15 should be rules or not. And the question is
16 incentives that people have, whether they should
17 follow the rules or not.

18 I mean, I'm not sure that if I'm
19 designing a system for this, I want to follow
20 802.11, because heck, that constrains me, but let's
21 go ahead with other comments.

22 MR. CALABRESE: Okay. Thanks. Yeah, I
23 just want to mention, I have a -- you asked about
24 the positives and negatives of unlicensed, and
25 although I have a long list of positives, the one

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1 negative I'm reminded of by this discussion, which
2 is that wi-fi success creates the temptation to
3 impose service rules that tend to protect or lock
4 in wi-fi, which I don't believe should protect or
5 lock in wi-fi, or any other current technology. I
6 think we saw quite a few comments that said, you
7 know, that we may need to have some -- the
8 Commission may need to impose some type of service
9 rules on the 2.4 gigahertz unlicensed band in order
10 to make the most of this wi-fi development that we
11 have. And it may well be that we will decide we
12 need some new dedicated space for unlicensed
13 wireless networking. But ideally, those sort of
14 rules of the road should not be shaped to prefer
15 any particular application, and especially no
16 current technology.

17 We probably do need protocols and
18 etiquette to facilitate wireless networking, but
19 they should be as open and as neutral as possible.

20 And I'd encourage David Reed to say something
21 about this, because he helped develop those sort of
22 protocols for the Internet. And an Internet-based
23 model in the air is what we need. We must --
24 essentially, these protocols should certainly not
25 come at the price of limiting sort of free-wheeling

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1 innovation that's possible on the current -- what
2 we once called the junk band of spectrum at 2.4.

3 DR. LUCKY: Okay. I want to turn it
4 over to Dewayne for a minute, but let me just
5 insert the devil's advocacy here for a minute. The
6 problem with protocols is they change, you know.
7 And if you lock in on particular rules - I mean,
8 look at 802.11 is migrating to a lot of different
9 versions. If you set rules, wouldn't you be taking
10 away some of the freedom to innovate that is the
11 important cornerstone in unlicensed band? Dewayne.

12 MR. HENDRICKS: Okay. I wanted to
13 address the meltdown question. If you look back on
14 the historical record on Part 15, NCR in 1991 filed
15 comments that effectively said they expected the
16 unlicensed band to meltdown. This is in '91.

17 Three years ago, Lucent filed comments
18 that basically said the same thing, so what we have
19 is that between '91 and three years ago it didn't
20 meltdown. And we hear a lot of analytical evidence
21 about it has meltdown, but I've got to tell you,
22 where I am in the Bay Area, and having operated
23 since '96 on those three bands, I haven't seen any
24 meltdown, or ways in which you can engineer around
25 any type of interference. So what I would say in

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1 general is that what's missing here, and I would
2 encourage the Commission and, in fact, the TAC,
3 when we reformed four years ago basically said
4 look, you're an agency that doesn't measure what it
5 regulates, which is the radio spectrum. If you
6 look at the EPA, it measures what it regulates.
7 The Commission never has. And what we did is we
8 proposed to the Commission that it needed to embark
9 on a major study of the spectrum and look at noise.

10 Okay?

11 So we complete -- the TAC has sort of
12 completed the first phase of our noise study, but
13 what needs to happen on an ongoing basis is
14 measurement of the spectrum, particularly say the
15 unlicensed bands across the country, on an ongoing
16 basis to determine whether or not there really is a
17 meltdown. And essentially, what we tried to do is
18 develop some objective measures that would be used
19 to determine when that happened.

20 DR. LUCKY: You know, I think your
21 experience is particularly valuable, Dewayne,
22 because I look at the Bay Area as being sort of the
23 canary in the coal mine. You know, maybe we don't
24 have to measure the whole country, you know, we
25 just see if San Francisco dies, and then we'd know.

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1 Larry, you wanted to comment.

2 PROF. LESSIG: Right. I agree with
3 Dewayne, but I think that the perspective should be
4 how do we establish an environment for the widest
5 range of experimentation, protected both against
6 incumbents trying to protect themselves, and
7 against the system melting down? And in this
8 context, I think thinking about different bands
9 differently helps. So I think in Microsoft's
10 comments, for example, they suggested a protocol
11 layer, a MAC layer in the 5g band, a lot of issues
12 about what the protocol would be, and who would set
13 it, of course. How else could there be a proposal
14 by Microsoft without those questions, but still I
15 think it's a good proposal, because in that
16 context, at least we could have a protocol band
17 that would avoid exactly this kind of meltdown
18 problem.

19 It would be a mistake, though, to take
20 that idea and impose it across the board to all of
21 the bands that are unlicensed. What's got to
22 happen is a wide range of environments that
23 encourage lots of different experimentation here,
24 and develop models that can challenge the owned or
25 licensed bands.

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1 DR. LUCKY: Okay. Bob Phaneuf, what's
2 your experience in this area?

3 MR. PHANEUF: Well, I've got a
4 different problem than most of you. I probably
5 have more spectrum in one radio than the world has
6 used to date.

7 DR. LUCKY: Can we have some of it?

8 MR. PHANEUF: Yeah. It turns out my
9 radios are 60 gigahertz right now, and it's very
10 easy for me to transmit full-duplex 1.25 gigahertz
11 data rate real stuff. It's a wireless link to
12 fiber.

13 My problem with the licensed band, or
14 the unlicensed band, not a problem really, is that
15 I was really -- I, being my company, was the first
16 guy in. And when you're the first guy in and
17 you're trying to develop new spectrum, this amount
18 of spectrum, everybody thinks they want it, but
19 they really don't know what they want to do with
20 it. And so each customer you go to has a little
21 bit different spin on -- I mean, I have just this
22 wireless link that can do, I think, most anything,
23 but they want to interface it with different kind
24 of switches, different kind of clock rates,
25 different kind of protocols, and so we have to

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1 change.

2 Every now and then we'll have to change
3 our back end. Very rarely do we have to change the
4 microwave part of it, the millimeter wave part of
5 it, but the back end. And the flexibility of the
6 unlicensed band allows me to go almost any
7 customer, whether it's a campus network or the big
8 carriers are just playing with us now, by the way.
9 That's my problem.

10 I've got two and four radios on top of
11 a lot of buildings. The only ones that have a
12 decent number, I think I've got oh, maybe 20 in
13 Japan that are linked together. We thought
14 Expedient was going to be our big hope down in
15 Miami, and they kind of caved in and went out of
16 business.

17 But the problem is, the -- I couldn't
18 have filled any of these to anybody if I didn't
19 have the flexibility that the unlicensed band gives
20 us, and that's, I guess, my big message. I don't
21 think -- I think there's always going to be
22 problems. I've had like five radios on the same
23 frequency on one roof pointing at different
24 directions. Of course, my beam is a needle, and
25 that works pretty well. And what happens when it

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1 doesn't work, you move it a little bit.

2 I mean, you can solve these problems in
3 a very practical sense. The thing I'll tell you
4 too is, that time I take a look at the design of
5 the radio I can think of improvements, and that's
6 probably the way it's going to happen in terms of
7 correcting our mistakes, or interference mistakes.

8 We really can be clever, but right now the big
9 thing is to get out there and get using this stuff,
10 because if we don't really get using the stuff,
11 then we really don't know where the bodies are
12 buried. We don't know what problems we have to
13 solve, so I do think that the -- and I have a
14 tendency to focus on the fundamental link-to-link.

15 These are point-to-point systems, by the way,
16 because of their frequencies, but they are
17 networked and they network pretty well.

18 But one of the things that's kind of
19 amusing to me is this panel seems more like a
20 computer data processing panel than it does an RF
21 panel. It turns out that there's still some of us
22 left that think that bandwidth is really
23 information rate, so I guess that's --

24 DR. LUCKY: Okay. Thanks, Bob. I'd
25 like to turn it over to questions and comments from

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1 the audience now. The two questions on the table
2 are first, what's good and bad about Unlicensed
3 Spectrum? Now I think what we have on the panel is
4 everyone loved it, you know. They want more of it,
5 but perhaps there's somebody out there who could
6 speak for, perhaps an incumbent that feels like
7 they're being undercut by this, or hurt by it,
8 interference or whatever. So the two questions are
9 what's good and bad about unlicensed, and will this
10 melt down? So comments from the audience. Sir?

11 AUDIENCE MEMBER: Yes. With respect to
12 any kind of hyperbolic statement like spectral
13 meltdown or the converse, that wireless unlicensed
14 is the second coming masqueraded as technology. I
15 think one does well to try to analyze the source of
16 the comment.

17 Do you think that, you know, the claims
18 that, or as I would contend, the myth of over-
19 spectral congestion say, for example, in 2.4, do
20 you think much of that comes from disingenuous
21 parties who may have a vested interest in making
22 everyone think that it doesn't work?

23 DR. LUCKY: Some of it does come from
24 that. I think it's also, in my own opinion, that a
25 lot of the technology statements are driven by

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1 fashion. Somebody says, you know, it's going to
2 meltdown, and it becomes very fashionable to say
3 that, and so everybody starts worrying about it.
4 And it turns out that there is no real data behind
5 that statement, that it just becomes common
6 knowledge that this is going to meltdown.

7 Other comments, questions? Yes.

8 AUDIENCE MEMBER: I think I heard
9 several of the panelists discuss the problem of
10 interference between intelligent and unintelligent
11 uses of unlicensed, where you have in the way in
12 the commons you have two types of farmers. You
13 have those farmers who are bringing in with them
14 intelligent technology so that their cows can, or
15 their sheep can kind of ease back when they see
16 problems. But in a way, the other farmers who
17 don't choose to use that technology can free ride.

18 And I'm wondering if one of the suggestions that
19 may come out of this is creating or segregating a
20 part of the unlicensed bands for technologies that
21 incorporate some general intelligent or cognitive
22 protocols so that they can have their own place to
23 innovate, as long as no particular technology or
24 solution is endorsed.

25 DR. LUCKY: Larry.

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1 PROF. LESSIG: I think it's a
2 critically important issue, especially as it
3 relates to incumbent technologies. The unfortunate
4 presumption so far in the regulatory context has
5 been to protect the unintelligent, and to force the
6 intelligent to be really, really super intelligent
7 so that they don't --- and I believe in Darwin.
8 Right?

9 I think we should have a regulatory
10 Darwin that says if there are unintelligent
11 technologies, we should be tilting against them so
12 that we have a move towards a much higher bits-per-
13 second throughput here in the use of spectrum, so
14 this is a combination both of band, of what we call
15 bandwidth, but also computational power that could
16 really increase the total capacity. I think that's
17 the message, in particular, David was offering
18 here. But the only way we're going to get there is
19 to stop preferring or --- through regulatory
20 structures preferring the unintelligent structures
21 over the intelligent ones.

22 DR. LUCKY: Interesting. Other
23 comments? Yes.

24 MR. CHAMBERLAIN: I think the 2.4
25 gigahertz spectrum is a perfect example of this. I

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1 mean, for instance, you have the unintelligent
2 microwave oven, just spews out energy in that band.

3 And then you have a telephone that needs to
4 operate in the kitchen, so what happens is you
5 devise a way of making that work.

6 Now if you start segregating that band,
7 depending, you know --- now you're limiting your
8 ability to jump around that information and energy,
9 because I don't think the Commission or anyone can
10 figure out what all devices are going to be
11 created.

12 You have to give them, you know, give
13 the people within that band the ability to deal
14 with the situation, so you take a look at what
15 spectrum you're in from the marketplace side. You
16 take a look at it, you innovate, and you come out
17 with new products. I mean, I think it's fairly
18 simple.

19 DR. LUCKY: Sir. You've got one?

20 AUDIENCE MEMBER: Yes.

21 DR. LUCKY: Okay. Fine. Go ahead.

22 See, this is the comments, but there are rules.

23 AUDIENCE MEMBER: Actually, that's sort
24 of what I was going to comment on. I don't see
25 there being a meltdown. I think ultimately we're

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1 going to need more unlicensed spectrum because of
2 increased demands but, you know, there's been some
3 mention about 802.11, and some issue about whether
4 rules, you know, should favor some technology or
5 not.

6 Actually, I think the industry
7 standards bodies have done a very good job of
8 creating some very innovative products with the
9 cooperation of many, many companies in the process.

10 And my understanding is that there is actually a
11 federal law that requires government agencies, in
12 their procurement policies, to favor industry --
13 you know, open consensus standards, and also
14 requires regulatory agencies to consider those
15 standards in the regulatory proceedings.

16 I think the idea of the commons is a
17 good idea, and industry will make it work. As, I
18 believe it's Mr. Reed said, we can pretty much
19 invent ourselves out of, you know, things in the
20 future, as long as we do it in a cooperative way.
21 This may require that the Commission consider some
22 general sorts of requirements for interference
23 avoidance and mitigation techniques in the
24 unlicensed bands in the future, and there are task
25 groups within the standards bodies that are working

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1 on exactly those sorts of things. 802 just
2 recently created a co-existence technical advisory
3 group.

4 Anyway, I guess what I'm trying to say
5 is no, I don't think there's going to be a
6 meltdown, but I think that there needs to be some
7 thought to protecting all of those people that play
8 by rules that are designed to promote spectral
9 efficiency, from what I would characterize as rogue
10 systems that simply don't care. They just spew, as
11 it was put, without any regard to other occupants
12 that may be trying to use the spectrum
13 cooperatively. Thank you.

14 DR. LUCKY: Okay. We have a comment
15 over here.

16 AUDIENCE MEMBER: My question was,
17 we've heard a little bit about whether the
18 unlicensed --- whether we need more spectrum
19 assigned by unlicensed means or not. I guess the
20 question is, do we need more? And if we did, where
21 in the band should it be of the things that are up
22 for grabs now, that it might be in the near future?

23 Where should the FCC be focusing on making
24 decisions to expand the use of Unlicensed Spectrum?
25 And then maybe a second part of the question is,

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1 we've heard about the utility or the disadvantages
2 of having rules for unlicensed. What else could
3 the FCC do that you think would either undermine
4 the use of Unlicensed Spectrum now, or is there
5 anything that they could do beyond more spectrum
6 that would assist?

7 DR. LUCKY: Okay. That actually is the
8 next set of questions we're going to move on to, so
9 I think you'll be very timely. I'll get one more
10 here, and then we're going to move on. Sir, I'll -
11 -- we have --- okay, well two more.

12 AUDIENCE MEMBER: Good morning. Is
13 this on?

14 DR. LUCKY: Yes, you're on.

15 AUDIENCE MEMBER: Okay. One of the
16 things I've been hearing is people have been
17 reaching for analogies to try to understand
18 spectrum, and I've been trying to think about that
19 for a while, and I've not yet found an analogy
20 that's perfect. I just wanted to caution that we
21 not think that spectrum is like either traffic,
22 which one of the panelists mentioned earlier this
23 morning. Cars cannot pass through each other
24 without interference, but radio waves can, in fact,
25 pass through each other without interfering.

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1 It's not really like grass either, but
2 I haven't been able to find the analogy that's as
3 interesting as cars passing through each other to
4 explain why spectrum is not like grass.

5 I think the most powerful analogy I
6 found is actually due to David Reed, who pointed
7 out that radio waves are ripples on the pond, and
8 they can, in fact, pass through each other. And if
9 you watch rain drop on water, you can actually see
10 the circles expanding, and you can still see the
11 circles from each individual drop, even though
12 there are many drops. And that's a pretty good
13 analogy.

14 And I don't believe that there's any --
15 - that there's going to be a meltdown. It's like
16 ripples on a pond. There are no wake zones
17 sometimes around docks and stuff, but in the open
18 ocean you don't actually have to have a limit on
19 how big of a wake a ship can make, because there's
20 really no incentive for the ship to make as big of
21 a wake as possible. It just needs to get from
22 where it's coming from to where it's going.

23 DR. LUCKY: Well, I would say that
24 David's point was that there's --- that
25 interference doesn't --- waves do pass through each

1 other. But unfortunately, the damage occurs in the
2 receiver design. And that, in fact, you have
3 legacy receivers out there that are not able to
4 disambiguate these ripples in the pond, so that's -
5 -- this is a problem that always confronts the FCC,
6 is you have legacy environments that don't --- that
7 play by old rules that may not be technologically
8 advanced.

9 Okay. We had one more over there, and
10 then we'll move on.

11 AUDIENCE MEMBER: I'd like to comment
12 on Professor Lessig's comment about having a bias
13 in favor of intelligent systems that tend not to be
14 better behaved. The problem with that is, what is
15 good behavior can be very peculiar to the goals of
16 the system, and so you may well have a system that
17 has a good set of rules internal to itself, but
18 when the next new activity comes around, its
19 definition of what is being a good and cooperative
20 is different. And so, in effect, you can see rules
21 for -- or biases in favor of intelligibility become
22 barriers to entry.

23 Although I -- the second thing I'd say
24 is that we're not --- not all Part 15 is the same,
25 and that we do not automatically have to have every

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1 band be a classic Part 15 with a power limitation,
2 and no other limitations. Look at the PCS Part 15,
3 and you've got a huge realm of ways of having
4 different Part 15s. Thanks.

5 DR. LUCKY: Larry, would you like to
6 respond?

7 PROF. LESSIG: Yes. I was -- this
8 actually picks up on this example of the microwave
9 oven. I think we should distinguish between a bias
10 in the regulatory context, and a bias in the
11 marketplace. I don't think we have to worry about
12 the marketplace. If you've got microwave ovens
13 that are putting off too much --- too high
14 emissions that's interfering with some other use,
15 then you'll have microwave manufacturers who say we
16 have zero-emission microwaves. This is the
17 competitive process, that you have better
18 production of products that people can use within
19 their house.

20 The particular bias I'm worried about
21 is where somebody doesn't have to rely on the
22 competitive marketplace in order to sell their
23 products, but they can go to the government, and
24 they can say to the government look, this new use
25 of spectrum is making my stupid use of spectrum not

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